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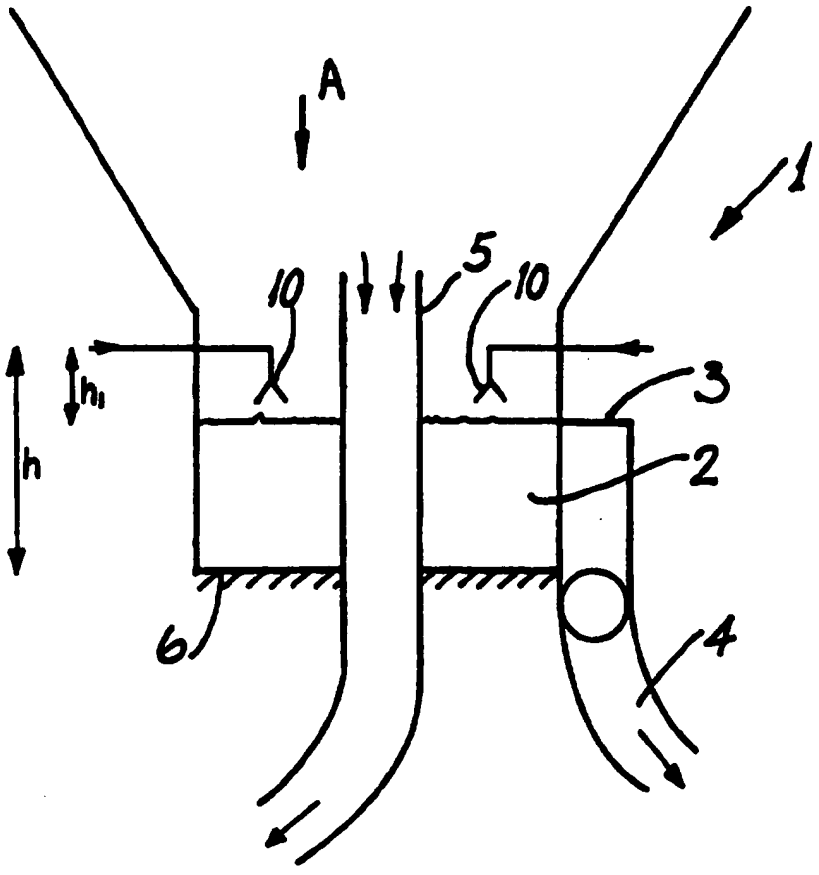
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Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: A METHOD AND APPARATUS FOR SPRAY-DRYING

(57) Abstract

A spray dryer (1) for milk powder has an internal fluidised bed (2) of powder material and at least one spray unit (10) for spraying additional material onto the milk powder in the fluidised bed. The additional material may be an oil or water based material which may optionally include additives.



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A METHOD AND APPARTUS FOR SPRAY-DRYING

The invention relates to a method and apparatus for drying, in particular to a method for producing skim milk powder, and to a spray dryer, particularly for use in a method for producing milk powder.

It is well known to add various additives to milk powder during production. There are, however, considerable difficulties in adding such additional materials in that it is very difficult to accurately add additional materials to achieve a desired final product. Very often excess additional material must be added which is lost in the process.

This invention is directed towards providing an improved method and apparatus for adding additional materials, particularly to milk powder.

According to one aspect, the invention provides a method for producing milk powder comprising the steps of:-

atomising a milk concentrate; and

drying the atomised milk concentrate in a dryer having an internal fluidised bed;

characterised in that the method includes the step of:-

spraying additional liquid material onto the internal fluidised bed of milk powder.

In one embodiment of the invention, the additional liquid material is sprayed onto the internal fluidised bed from a height of at least 100 mm, preferably approximately 200 mm above the top of the bed.

In a preferred arrangement, the additional liquid is sprayed onto the bed at a height of at least 500 mm, preferably approximately 600 mm above the floor of the bed.

In a particularly preferred embodiment of the invention, the additional material is sprayed onto the bed from at least one nozzle directed onto the bed. Preferably, the additional material is sprayed onto the bed from at least two spaced-apart nozzles. The nozzles may be radially and/or circumferentially spaced-apart.

In a particularly preferred arrangement, the additional liquid material is sprayed onto the bed from four nozzles which are equi-spaced circumferentially over the internal fluidised bed. Alternatively, the nozzles may be equi-spaced radially over the bed.

In one embodiment of the invention, the same additional liquid material is sprayed from each nozzle.

In another embodiment of the invention, different liquid materials are sprayed from different nozzles.

In a preferred embodiment of the invention, the additional liquid material is sprayed onto the fluidised bed at a weight % of less than 5% of the material of the internal fluidised bed.

The additional material may be of water based liquid, or an oil based liquid which may contain additives, milk based liquid which may contain additives or any suitable material including water or milk based sugar solutions or any combination of these. The oil based liquid may be lecithin which is preferably sprayed on at a rate of less

than 1% by weight. The additional material may be a heat labile material such as vitamins. The additional material may be an agglomerating agent to improve the agglomeration of the powder.

The method may be used to produce any suitable milk powder including skim milk powder and fat filled milk powder.

In another aspect, the invention provides a spray dryer having an internal fluidised bed characterised in that the dryer includes means for spraying additional liquid material onto the internal fluidised bed of powder material.

In one embodiment of the invention, the means for spraying additional liquid material comprises at least one spray nozzle.

Preferably, there at least two and typically four nozzles which are substantially equi-spaced apart over the internal fluidised bed of the dryer. The nozzles may be radially and/or circumferentially spaced-apart.

In one arrangement, the nozzles are at the same height with respect to the floor of the bed.

In another arrangement, the nozzles are at different heights with respect to the floor of the bed.

In a preferred embodiment of the invention, the or each nozzle is located at the height of at least 500 mm, and most preferably approximately 600 mm above the floor of the bed.

The invention will be more clearly understood from the following description thereof, given by way of example

only, with reference to the accompanying drawings, in which:-

Fig. 1 is a schematic view of the lower end of a spray dryer according to the invention;

Fig. 2 is a plan view in the direction of the arrow A in Fig. 1;

Fig. 3 is a schematic view of the lower end of another spray dryer according to the invention; and

Fig. 4 is a plan view in the direction of the arrow B in Fig. 3.

Referring to the drawings, there is illustrated portion of a spray dryer according to the invention, indicated generally by the reference numeral 1. The spray dryer 1 has an internal fluidised bed 2 for powder material, particularly milk powder. Powder exits the dryer 1 over a weir 3 to an outlet line 4. Air is drawn through the dryer along an internal lower duct 5 located substantially centrally with respect to the internal fluidised bed 2. The dryer has a floor 6 which is typically about 4 meters in diameter and the air duct 5 typically is about 1.5 meters in diameter.

Means for spraying additional liquid material onto the internal fluidised bed 2 of powder material in this case comprises at least one, preferably at least two and in this case, most preferably four spray nozzles 10 which in this case are equi-spaced circumferentially over the internal fluidised bed 2. In this case, each of the nozzles 10 is located at the same height h above the floor 6 of the bed 2. The height h is preferably at least 500 mm and in this case, approximately 600 mm. This

corresponds to a height h_1 above the top of the bed 2 of at least 100 mm, and preferably approximately 200 mm.

The nozzles 10 may be used to spray any suitable additional liquid material onto the internal fluidised bed 2. For example, the nozzles may be used to spray additional liquid material onto the fluidised bed of milk powder at a weight percentage of less than 5% of the material of the internal fluidised bed. The additional liquid material may be of water based liquid, or an oil based liquid which may contain additives, milk based liquid which may contain additives or any suitable material including water or milk based sugar solutions or any combination of these. The oil based liquid may be lecithin. The additional material may be a heat labile material such as vitamins. The additional material may be an agglomerating agent to improve the agglomeration of the powder. In the case of lecithin, the lecithin may be sprayed onto the milk powder at a weight percentage of less than 1%.

The spray nozzle arrangement may be configured to spray with or without air entrainment.

The method for producing milk powder according to the invention involves atomising the milk concentrate and drying the atomised milk concentrate in the dryer before spraying one or a number of different additional liquid materials onto the internal fluidised bed of milk powder. The milk powder may be a skim milk powder or a fat filled milk powder.

The principal advantage of the invention is in providing an integrated system for producing milk powder with any desired coating. The milk powder is sprayed with the additional material in situ in the fluidised bed dryer.

It will be appreciated that the spray nozzles may be arranged in any desired configuration. For example, to take account of the movement of the fluidised bed in use, one, two or more spray heads may be arranged along a single radially extending feed line. One such arrangement is illustrated in Figs. 3 and 4. Figs. 3 and 4 are similar to Figs. 1 and 2 and like parts are identified by the same reference numerals. In this case, there are two spray heads 10 which are equi-spaced in a radial direction.

It will also be appreciated that the operation of the spray nozzles may be controlled to achieve any desired result. The spray may be matched to the fluidised bed. Different nozzles may be supplied with different additional materials, the nozzles being activated, as required.

Many variations on the specific embodiments of the invention described will be readily apparent and accordingly the invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail.

CLAIMS

1. A method for producing milk powder comprising the steps of:-

atomising a milk concentrate; and

drying the atomised milk concentrate in a dryer having an internal fluidised bed;

characterised in that the method includes the step of:-

spraying additional liquid material onto the internal fluidised bed of milk powder.

2. A method as claimed in claim 1 wherein the additional liquid material is sprayed onto the internal fluidised bed from a height of at least 100 mm above the top of the bed.

3. A method as claimed in claim 1 and 2 wherein the additional liquid material is sprayed onto the internal fluidised bed from a height of approximately 200 mm above the top of the bed.

4. A method as claimed in any preceding claim wherein the additional liquid is sprayed onto the bed at a height of at least 500 mm above the floor of the bed.

5. A method as claimed in any preceding claim wherein the additional liquid is sprayed onto the bed at a height of approximately 600 mm above the floor of the bed.

6. A method as claimed in any preceding claim wherein the additional material is sprayed onto the bed from at least one nozzle directed onto the bed.

7. A method as claimed in claim 6 wherein the additional material is sprayed onto the bed from at least two spaced-apart nozzles.

8. A method as claimed in claim 7 wherein the nozzles are radially spaced-apart.

9. A method as claimed in claim 7 or 8 wherein the nozzles are circumferentially spaced-apart.

10. A method as claimed in claim 9 wherein the additional liquid material is sprayed onto the bed from four nozzles which are equi-spaced circumferentially over the internal fluidised bed.

11. A method as claimed in claim 8 wherein the additional liquid material is sprayed onto the bed from at least two nozzles which are equi-spaced radially over the bed.

12. A method as claimed in any of claims 7 to 11 wherein the same additional liquid material is sprayed from each nozzle.

13. A method as claimed in any of claims 7 to 11 wherein different liquid materials are sprayed from different nozzles.

14. A method as claimed in any preceding claim wherein the additional liquid material is sprayed onto the fluidised bed at a weight % of less than 5% of the material of the internal fluidised bed.

15. A method as claimed in any preceding claim wherein the additional material is a water based liquid containing additives.

16. A method as claimed in any preceding claim wherein the additional material is an oil based liquid which may optionally contain additives.

17. A method as claimed in any preceding claim wherein the additional liquid material includes lecithin.

18. A method as claimed in claim 11 wherein lecithin is sprayed onto the fluidised bed at a weight % of less than 1% of the material of the internal fluidised bed.

19. A method as claimed in any preceding claim wherein the additional liquid material comprises vitamins.

20. A method for producing milk powder substantially as hereinbefore described with reference to the accompanying claims.

21. Milk powder whenever produced by a method as claimed in any preceding claim.

22. Skim milk powder whenever produced by a method as claimed in any of claims 1 to 20.

23. Fat filled milk powder whenever produced by a method as claimed in any of claims 1 to 20.

24. A spray dryer having an internal fluidised bed characterised in that the dryer includes means for

spraying additional liquid material onto the internal fluidised bed of powder material.

25. A spray dryer as claimed in claim 24 wherein the means for spraying additional liquid material comprises at least one spray nozzle.

26. A spray dryer as claimed in claim 25 wherein there are at least two spray nozzles.

27. A spray dryer as claimed in claim 26 wherein the nozzles are radially spaced-apart.

28. A spray dryer as claimed in claim 26 or 27 wherein the nozzles are circumferentially spaced-apart.

29. A spray dryer as claimed in any of claims 26 to 28 wherein there are four nozzles which are substantially equi-spaced-apart over the internal fluidised bed of the dryer.

30. A spray dryer as claimed in any of claims 26 to 29 wherein the nozzles are at the same height with respect to the floor of the bed.

31. A spray dryer as claimed in any of claims 26 to 29 wherein the nozzles are at different heights with respect to the floor of the bed.

32. A spray dryer as claimed in any of claims 26 to 31 wherein each nozzle is located at a height of at least 500 mm above the floor of the bed.

33. A spray dryer as claimed in any of claims 26 to 32 wherein the or each nozzle is located at a height of approximately 600 mm above the floor of the bed.

34. A spray dryer substantially as hereinbefore described with reference to the accompanying drawings.

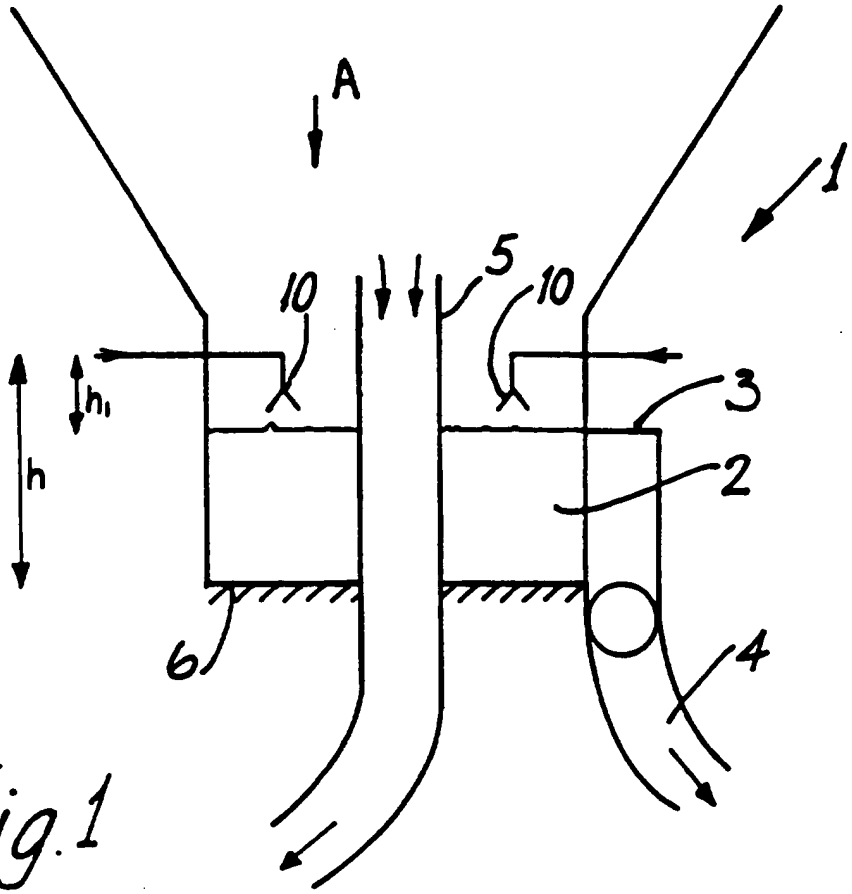


Fig.1

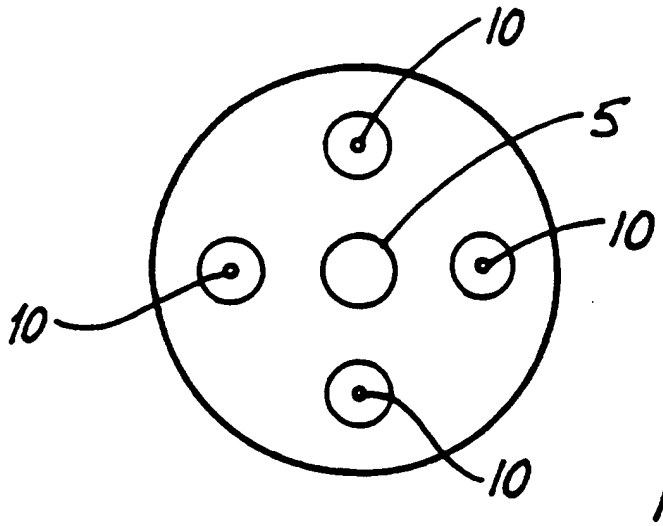


Fig.2

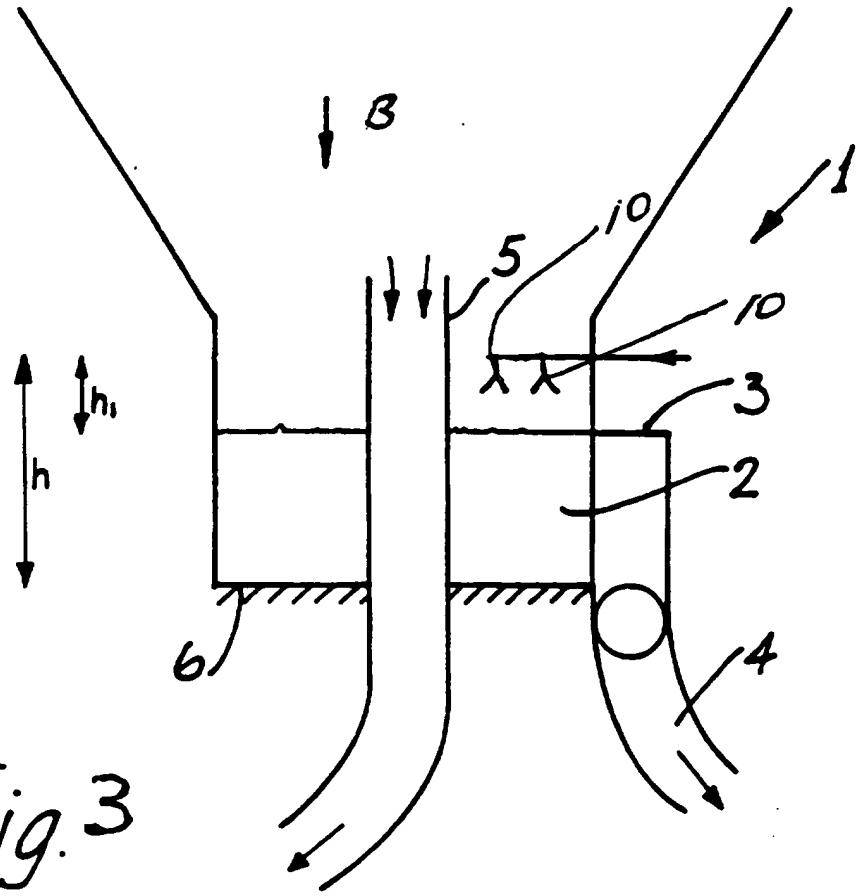


Fig. 3

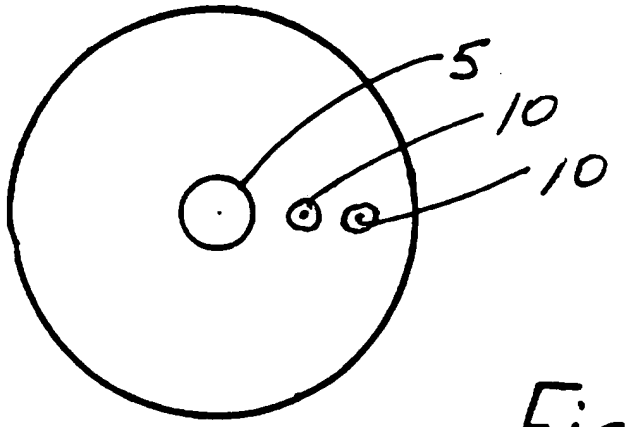


Fig. 4

INTERNATIONAL SEARCH REPORT

I ational Application No
PCT/IE 95/00054

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A23C1/04 A23C1/05 B01D1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A23C B01D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 334 982 (OHKAWARA KAKOHKI CO) 4 October 1989 see page 1, line 15 - line 26; claims 1-7	1-6,14, 15,20, 21,24, 25,34
Y	see page 4, line 40 - page 5, line 17; figure 1	17,18

X	WO,A,90 14143 (OLIN CO) 29 November 1990 see page 6, line 1-10; claims 14-27 see page 6, line 6 - line 16	1-6, 20-22, 24,25,34

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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7 February 1996	20.02.96
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	VOEDINGSMIDDELENTECHNOLOGIE, vol. 21, no. 21, 1988 pages 21-24, P. VAN MIL ET AL. 'Eigenschappen van enkele zuivelprodukten gedroogd in een meerfasendroger' see page 21 - page 22; figure 1	17,18
A	DAIRY INDUSTRIES INTERNATIONAL, vol. 52, no. 5, 1987 pages 31-34, ANON. 'Specialist milk powders from Maelor Creamery' see page 31, column 2 see page 33, column 1	1-6, 14-16, 20-25,34
A	NEW ZEALAND JOURNAL OF DAIRY SCIENCE AND TECHNOLOGY, vol. 7, no. 1, 1972 pages 21-22, A. BALDWIN ET AL. 'Instant milk powder' see page 22	1,15-18
A	EP,A,0 097 484 (NIRO ATOMIZER) 4 January 1984	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IE 95/00054

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-334982	04-10-89	US-A-	5044093	03-09-91
WO-A-9014143	29-11-90	US-A-	5085847	04-02-92
		AU-B-	632581	07-01-93
		AU-B-	5658190	18-12-90
		CN-A,B	1047265	28-11-90
		DE-D-	69020348	27-07-95
		EP-A-	0473644	11-03-92
		JP-T-	5500039	14-01-93
		US-A-	5149398	22-09-92
EP-A-97484	04-01-84	US-A-	4490403	25-12-84